Public Report ESA-003-3
FINAL

Company	Pittsburgh Corning	**ESA Dates**	22-24 January 2008
Plant	Port Allegany Plant	**ESA Type**	Process Heating
Product	Glass Blocks	**ESA Specialist**	Robert De Saro

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction: An Energy Savings Assessment (ESA) was carried out at Pittsburgh Corning's plant in Port Allegany, PA. Pittsburgh Corning makes glass blocks. The assessment was supported by plant personnel Dana Leet (the plant lead), Eric Swartwout, Harry Fleming, David Fair, Tim Bizzaro, and Bob Hink. In addition, the plant manager Keith Kelly attended the introduction and final meeting. The plant production manager also attended the final meeting. DOE Process Heating Specialist Robert De Saro led the assessment.

Objective of ESA: The objective was to train the plant personnel in data collection and the use of the PHAST software, to provide an understanding of the fundamental concepts related to PHAST, to collect data on selected pieces of equipment, to evaluate the collected data using PHAST, and to identify and evaluate possible energy savings.

Focus of Assessment: The focus of the assessment was on process heating equipment that uses natural gas fuel. The plant has one regenerative glass tank operating at 81% capacity and another tank decommissioned. The tank has four lines each having a forehearth, lehr, and forming equipment. It is electrically boosted. Also, a distributor cools the glass and feeds the glass to each of the forehearths. The assessment team decided to focus on the tank/regenerator, distributor, forehearth number 3, lehr number 3, and the burners on the forming machine's conveyor belts.

Approach for ESA: The assessment included a) a plant tour, b) introduction to the fundamentals of combustion, heat transfer, and ways to reduce the energy of process heaters, c) demonstration of PHAST, d) data collection from Pittsburgh Corning's equipment, e) inputting the data into PHAST and observing the energy balances and major energy flows, and f) analysis of energy savings opportunities using PHAST. Pittsburgh Corning's data collection system was used to determine the firing rate of equipment, the flue gas temperature and oxygen content of their furnace and forehearths. Wall temperature measurements were taken and flue gas analysis was conducted on those pieces of equipment that did not have this data recorded. In addition, feedstock throughputs were used. Since the equipment operates continuously, it was not necessary to calculate the heat storage of the equipment.

General Observations of Potential Opportunities: The furnace runs continuously for 8760 hours per year. Also, it operates in a steady state mode without much variation during a production run. When production runs are changed, however, the first two days require process adjustments and about 50% of the glass is rejected. All rejected glass is fed back into the furnace. Lately, the rejected glass has averaged about 28% annually. Historically, the rejected rate was 14% annually. The increase is due to more frequent job changes and the reduced furnace capacity. Pittsburgh Corning requires very low iron content in their glass, and consequently they carefully control their purchased raw batch. They are unable to use outside cullet as this would adversely affect their glass quality since even plate and container glass have iron contents above Pittsburgh Corning's maximum specification.

Of the equipment surveyed, the tank accounts for most of the energy and expends 228,097 MMBtu/year and 4,586,000 kWh/yr. This is followed by lehr number 3 at 8,876 MMBtu/year, the distributor at 8,760 MMBtu/year, forehearth number 3 at 6,203 MMBtu/year, and the conveyor belt burners on line 3 at 5,256 MMBtu/year. The tank is exceptionally well

maintained. The burners are tuned weekly and flue gas oxygen measurements are continuously recorded. The tank walls are sealed weekly so there are no openings for either air ingress or radiation losses. Cooling water losses, used to cool the batch chargers, are minimal. However, the tank's average wall temperature is high, about 380 ^{o}F. Also, operating at a throughput less than maximum produces a lowered specific energy use (MMBtu/ tons). The tank oxygen reading was about 3.5%. It is not possible to lower the oxygen content since that would cause glass quality problems. The tank fires at 26.1 MMBtu/hr and processes 5.08 tons/hr (based on the batch and cullet fed into the furnace) so its specific energy use is 5.14 MMBtu/ton. This corresponds to a thermal efficiency of about 43%. Since its flue gas temperature is 740 ^{o}F, its available energy, and therefore its maximum theoretical efficiency, is 75%.

The conveyor belt burners operate fuel rich so that carbon is produced which is used as a belt lubricant. Copious amounts of CO are produced as well. CO readings were off scale, above 1000 ppm.

The lehrs are opened at each end for product movement and therefore large amounts of air flows through them.

Pittsburgh Corning has two other plants that make insulation, located in Fresno, TX and Sedalia, MO.

Near Term Opportunities

1. Put a hood over the lehr's product inlet, and curtains on its outlet and inlet side through which the glass products move. This would reduce the air flow. If implemented on three of the four lehrs, this would save annually 6,044 MMBtu and $56,594.
2. Tune the conveyor belt burners to be on ratio with some excess air. Since the CO readings were off scale, estimates are provided at 10,000 ppm (0.1%) CO and 50,000 ppm (0.5%) CO. For all four lines, the annual energy savings would be between 1,472 MMBtu and 7,359 MMBtu. The annual cost savings would be between $13,782 and $68,899.
3. Install a Btu meter to measure the actual natural gas heat content and adjust the burners automatically. This would save some energy and remove the manual, and potentially error prone, current method.

Medium Term Opportunities

1. Increase throughput to match the design capacity of the melter, 150 tons per day. This would have two effects. First, the furnace would become more energy efficient, and second, the rejected glass would be reduced from its current 28% to its historical value of 14%. The increased throughput can come from eliminating the purchase of overseas product that is repackaged and sold. Since the furnace efficiency would be improved, it is possible that Pittsburgh Corning's per ton price would be low enough to accomplish this. The energy savings is calculated by determining the energy use with the above scenario and comparing that to producing the same amount of glass using the current method. The annual energy savings would be 84,315 MMBtu and $789,441.
2. Cascade the distributor flue gases into the lehrs to reduce their burner firing rate. The savings is based on the lower of two sets of numbers determined during the assessment. The annual savings is 2,102 MMBtu and $19,685.
3. Increase wall insulation on the distributor and tank. This would save annually 28,996 MMBtu and $271,486.
4. Reorganize the gas piping so that the gas meter readings will be more useful.

Long Term Opportunities

Preheat the batch to 400 ^{o}F. The annual savings would be 11,388 MMBtu/year and $106,626. This project has an unfavorable payback and is risky. However, this project might be feasible if either federal or state grant money was available.

- Note the Near Term, Medium Term, Long Term definitions:

  - Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
  - Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.
  - Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

Management Support and Comments:

DOE Contact at Plant/Company: (who DOE would contact for follow-up regarding progress in implementing ESA results…) Dana Leet, (814) 642-5229.